

REMARKS

Request for an Examiner's Interview

The Applicants' Attorney hereby requests an interview with the Examiner in order to expedite the prosecution of this case.

Pending Claims

Claims 1-5, 7-21, 24-32 are pending in the present application. Claims 24, 27, and 30-31 have been amended. Claims 6 and 22-23 have been withdrawn from consideration pursuant to 37 CFR §1.142(b) as being drawn to non-elected groups. Claims 6 and 22-23 are herein cancelled without prejudice. The Applicants retain the right to prosecute claims 6 and 22-23 in a divisional application. The Applicants respectfully requests reconsideration of the pending claims in light of the amendments, arguments, and remarks presented in this Amendment and Response.

Amendment to the Specification

The specification was amended to correct a typographical error in the title.

Objections to the Claims

Claim 26 has been objected to under 37 C.F.R. 1.75(c), as being of improper dependent form for failing to further limit the subject matter of the previous claims. Claim 26 has been canceled. Therefore, the Applicants respectfully request that the objection to claim 26 be withdrawn

Rejection under 35 U.S.C. §112

Claims 10 and 27-30 have been rejected under 35 U.S.C. §112 as failing to comply with the enablement requirement. In particular, the Office Action states that the specification does not enable one of ordinary skill in the art how to make an apparatus in which a parasitic antenna is coupled to the plasma chamber via a thermally conductive elastomer. The Applicants submit that thermally conductive elastomers are well known in the art. An elastomer is a rubber-like material that is typically vulcanized. There are numerous thermally conductive elastomers that are well known in the art.

Dependent claim 10 recites that the parasitic antenna is coupled to the plasma chamber via a thermally conductive elastomer. The Applicants submit that coupling an antenna to a plasma chamber with a conductive elastomer is well within the ability of one skilled in the art. Therefore, the Applicants respectfully request that the rejection of dependent claim 10 under 35 U.S.C. §112 be withdrawn.

Dependent claim 27 has been amended to recite a vertically-extending coil that comprises a parasitic antenna that is not coupled to any radio frequency (RF) source. The Applicants submit that the amendment to claim 27 overcomes the rejection under 35 U.S.C. §112. Therefore, the Applicants respectfully request that the rejection of dependent claim 27 under 35 U.S.C. §112 be withdrawn.

Rejections under 35 U.S.C. §102

Claims 1-3, 7-8, and 11 are rejected under 35 U.S.C. §102(b) as being anticipated

by U.S. Patent No. 5,567,268 to Kadomura (hereinafter “Kadomura”). Independent claim 1 recites a plasma immersion ion implant apparatus comprising a radio frequency antenna including an active antenna surrounding the plasma chamber and coupled to the RF source and a parasitic antenna surrounding the plasma chamber and not directly coupled to any RF source.

To anticipate a claim under 35 U.S.C. §102, a single reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught by the reference must be inherently present in the reference. Thus, a claim is anticipated by a reference only if each and every element of the claim is described, either expressly or inherently, in a single prior art reference.

In summary, the Applicants submit that Kadomura does not describe, either expressly or inherently, a plasma immersion ion implantation apparatus or any other type of ion implantation apparatus. In addition, Kadomura does not describe, either expressly or inherently any type of plasma processing apparatus (including ion implantation apparatus) that includes the parasitic antenna claimed in independent claim 1. Instead, as explained herein, Kadomura describes a plasma processing apparatus that is designed to operate with either two active antennas or with one active antenna and one de-energized (inactive) antenna. In operating modes where the Kadomura plasma processing apparatus operates with one active antenna and with one de-energized (inactive) antenna, the de-energized antenna is not equivalent to the parasitic antenna claimed in independent claim 1 and described in the present specification.

More specifically, Kadomura describes a plasma processing apparatus (hereinafter the “Kadomura apparatus”) that controls the ion/radical production ratio for applications, such as high-speed anisotropic etching. Kadomura FIG. 2 shows the Kadomura apparatus where a helicon wave plasma and an inductively coupled plasma are both excited in a dry etching apparatus. The helicon wave plasma is generated in the top area of the process chamber and the inductively coupled plasma is generated downstream. Kadomura FIG. 3 shows the Kadomura apparatus configured to produce only a helicon wave plasma in the top area of the process chamber by switching switch 35 on and switch 38 off.

The Applicants submit that Kadomura does not describe, either expressly or inherently, a plasma immersion ion implantation apparatus or any other type of ion implantation apparatus. Kadomura described a dry etching apparatus and does not described the use of the Kadomura apparatus for ion implantation.

The Office Action dated June 28, 2006 states on page 3 that Kadomura shows the claimed plasma apparatus including a parasitic antenna surrounding the plasma chamber and not directly coupled to any RF source. The Office Action indicates that Kadomura illustrates the parasitic antenna as reference numerals 31 or 32. The Office Action further states in connection with the rejections of dependent claims 2-3 that the parasitic antenna (reference numerals 31 or 22) can be considered either the vertically or the horizontally extending coil depending upon which coil is “left open.”

The Applicants submit that a coil that is “left open” is a de-energized antenna,

which means that the coil is not performing any antenna functions. That is, a “left open” coil does not receive a time varying electrical current and radiate a time-varying electromagnetic field or receive a time-varying electromagnetic field and generate a time varying electrical current.

A parasitic antenna as claimed in independent claim 1 and as described in the present specification is not just a coil that is “left open.” The term “parasitic” is used to indicate that a portion of the time-varying electromagnetic field that is radiated by the active antenna is coupled into the parasitic antenna in a manner that changes properties of the plasma, such as the plasma uniformity and the plasma density. For example, see paragraph 32 of the present specification.

Thus, the Applicants submit that independent claim 1 is not anticipated by Kadomura because Kadomura does not describe, either expressly or inherently, the claimed plasma immersion ion implantation apparatus that includes a parasitic antenna. Therefore, the Applicants submit that independent claim 1 is allowable and that dependent claims 2-5 and 7-21 are allowable as depending from an allowable base claim.

Rejections under 35 U.S.C. §103(a)

Claims 4, 5, 9, 12-21, 24-26, 31-32 have been rejected under 35 U.S.C. §103(a). Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of U.S. Patent No. 6,465,051 to Sahin et al. (hereinafter “Sahin”). Claim 5 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of Sahin and further in view of U.S. patent No. 5,888,413 to Okumura et al.

(hereinafter “Okumura”). Claim 9 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of U.S. patent No. 5,681,418 to Ishimaru (hereinafter “Ishimaru”). Claims 12-13 and 15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of U.S. Patent No. 5,556,501 to Collins et al. (hereinafter “Collins”). Claim 14 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of Collins and further in view of U.S. Patent No. 6,626,188 to Fitzsimmons et al. (hereinafter “Fitzsimmons”). Claim 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of Collins and further in view of U.S. Patent No. 5,824,607 to Trow et al. (hereinafter “Trow”). Claim 17 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of U.S. Patent No. 5,916,455 to Kumagai (hereinafter Kumagai). Claim 18 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of Collins. Claims 19-21 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kadomura in view of Collins.

Claims 24-26 and 31 are rejected under 35 U.S.C. §103(a) as being unpatentable over Collins in view of Trow. Claim 32 was rejected under 35 U.S.C. §103(a) as being unpatentable over Collins in view of Trow and further in view of Kumagai.

To be unpatentable under 35 U.S.C. §103(a), the differences between the subject matter sought to be patented and the prior art must be such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. There must be some suggestion or motivation,

either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the reference teachings.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of the ordinary skill in the art, to modify the references or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

As stated in connection with the rejection under 35 U.S.C. §102(b), Kadomura does not describe, either expressly or inherently, the plasma immersion ion implantation apparatus including the parasitic antenna that is claimed in independent claim 1. The Applicants submit that the prior art of record including Kadomura, Sahin, Okumura, Ishimaru, Collins, Fitzsimmons, Trow, and Kumagai do not teach or suggest all the claim limitations in independent claim 1. Therefore, the Applicants submit that dependent claims 4, 5, 9, and 12-21 are allowable as depending from an allowable base claim.

Independent claim 24 was rejected under 35 U.S.C. §103(a) as being unpatentable over Collins in view of Trow. The Office Action dated June 28, 2006 states on page 10 that Collins shows the invention substantially as claimed, but that Collins does not expressly disclose where the top conductive section is liquid cooled. The Office Action further states that Trow discloses where a top conductive section is cooled by liquid. The Office Action then concludes that it would have been obvious to one of ordinary skill in

the art at the time the invention was made to modify the apparatus of Collins so as to cool by liquid.

Independent claim 24 has been amended to recite a radio frequency antenna including a horizontally-extending coil positioned proximate to the horizontal planar dielectric section and a vertically-extending coil positioned proximate to the vertical cylindrical dielectric section. Both Collins and Trow describe only a vertically-extending coil that is positioned proximate to a vertical cylindrical dielectric section. Using only a vertically-extending coil provides sufficient control of the plasma for the etching and deposition processes describe in these prior art references. There is no teaching or suggestion in either Collins or Trow of using a radio frequency antenna that includes both a horizontally-extending coil positioned proximate to the horizontal planar dielectric section and a vertically-extending coil positioned proximate to the vertical cylindrical dielectric section.

Thus, the Applicants submit that the prior art of record including Collins and Trow do not teach or suggest a plasma chamber having all the claim limitations of independent claim 24 including the horizontally-extending coil and the vertically-extending coil. Therefore, the Applicants submit that independent claim 24 is allowable and that dependent claims 25 and 27-32 are allowable as depending from an allowable base claim.

CONCLUSION

The Applicants respectfully requests reconsideration of the pending claims in light of the amendments, remarks, and arguments presented in this Amendment and Response.

If, in the Examiner's opinion, a telephonic interview would expedite prosecution of the present application, the undersigned attorney would welcome the opportunity to discuss any outstanding issues, and to work with the Examiner toward placing the application in condition for allowance.

Respectfully submitted,

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